# CAT 2022 | SHIFT-2 | QUESTION PAPER

Time: 120 Mins | Maximum Marks: 198

**Important Instructions**

(i) Total Number of Questions: 66
(ii) Number of Questions in Verbal Ability and Reading Comprehension (VARC): 24
(iii) Number of Questions in Data Interpretation and Logical Reasoning (DILR): 20
(iv) Number of Questions in Quantitative Ability (QA): 22
(v) 40 minutes are allotted to attempt each section.
(vi) 4 answer options for each MCQ type question.
(vii) Answers are typed in the given space on the computer screen for Non-MCQ.
(viii) For each correct answer: + 3 marks
(ix) Negative marking (Applicable for wrong answers in MCQs): - 1 mark

## Verbal Ability and Reading Comprehension (VARC)

### Passage 1

**Directions (Q. 1 to 4):** *Read the following passage carefully and answer the questions that follow.*

Humans today make music. Think beyond all the qualifications that might trail after this bald statement: that only certain humans make music, that extensive training is involved, that many societies distinguish musical specialists from nonmusicians, that in today's societies, most listen to music rather than making it, and so forth. These qualifications, whatever their local merit, are moot in the face of the overarching truth that making music, considered from a cognitive and psychological vantage, is the province of all those who perceive and experience what is made. We are, almost all of us, musicians — everyone who can entrain (not necessarily dance) to a beat, who can recognise a repeated tune (not necessarily sing it), who can distinguish one instrument or one singing voice from another. I will often use an antique word, recently revived, to name this broader musical experience. Humans are musicking creatures. . . .

The set of capacities that enables musicking is a principal marker of modern humanity. There is nothing polemical in this assertion except a certain insistence, which will figure often in what follows, that musicking be included in our thinking about fundamental human commonalities. Capacities involved in musicking are many and take shape in complicated ways, arising from innate dispositions . . .

Most of these capacities overlap with nonmusical ones, though a few may be distinct and dedicated to musical perception and production. In the area of overlap, linguistic capacities seem to be particularly important, and humans are (in principle) language-makers in addition to music-makers — speaking creatures as well as musicking ones.

Humans are symbol-makers too, a feature tightly bound up with language, not so tightly with music. The species Cassirer dubbed Homo symbolicus cannot help but tangle musicking in webs of symbolic thought and expression, habitually making it a component of behavioural complexes that form such expression. But in fundamental features, musicking is neither language-like nor symbol-like, and from these differences, come many clues to its ancient emergence.

If musicking is a primary, shared trait of modern humans, then to describe its emergence is to detail the coalescing of that modernity. This took place, archaeologists are clear, over a very long durée: at least 50,000 years or so, more likely something closer to 200,000, depending in part on what that coalescence is taken to comprise. If we look back 20,000 years, a small portion of this long period, we reach the lives of humans whose musical capacities were probably little different from our own. As we look farther back, we reach

horizons where this similarity can no longer hold — perhaps 40,000 years ago, perhaps 70,000, perhaps 100,000. But we never cross a line before which all the cognitive capacities recruited in modern musicking abruptly disappear. Unless we embrace the incredible notion that music sprang forth in full-blown glory, its emergence will have to be tracked in gradualist terms across a long period. This is one general feature of a history of music's emergence . . . The history was at once sociocultural and biological . . . The capacities recruited in musicking are many, so describing its emergence involves following several or many separate strands.

**Q. 1. Which one of the following sets of terms best serves as keywords to the passage?**

1. Humans; Musicking; Linguistic capacities; Symbol-making; Modern humanity.
2. Humans; Psychological vantage; Musicking; Cassirer; Emergence of music.
3. Musicking; Cognitive psychology; Antique; Symbol-makers; Modernity.
4. Humans; Capacities; Language; Symbols; Modernity.

**Q. 2. Based on the passage, which one of the following statements is a valid argument about the emergence of music/musicking?**

1. 20,000 years ago, human musical capacities were not very different from what they are today.
2. Although musicking is not language-like, it shares the quality of being a form of expression.
3. All musical work is located in the overlap between linguistic capacity and music production.
4. Anyone who can perceive and experience music must be considered capable of being a music king.

**Q. 3. "Think beyond all the qualifications that might trail after this bald statement ..." In the context of the passage, what is the author trying to communicate in this quoted extract?**

1. A bald statement is one that requires no qualifications to infer its meaning.
2. Thinking beyond qualifications allows us to give free reign to musical expressions.
3. Although there may be many caveats and other considerations, the statement is essentially true.
4. A bald statement is one that is trailed by a series of qualifying clarifications and caveats.

**Q. 4. Which one of the following statements, if true, would weaken the author's claim that humans are musicking creatures?**

1. Musical capacities are primarily socio-cultural, which explains the wide diversity of musical forms.
2. Nonmusical capacities are of far greater consequence to human survival than the capacity for music.
3. From a cognitive and psychological vantage, musicking arises from unconscious dispositions, not conscious ones.
4. As musicking is neither language-like nor symbol-like, it is a much older form of expression.

## Passage 2

**Directions (Q. 5 to 8):** *Read the following passage carefully and answer the questions that follow.*

We begin with the emergence of the philosophy of the social sciences as an arena of thought and as a set of social institutions. The two characterisations overlap but are not congruent. Academic disciplines are social institutions. My view is that institutions are all those social entities that organise action: they link acting individuals into social structures. There are various kinds of institutions. Hegelians and Marxists emphasise universal institutions such as the family, rituals, governance, economy and the military. These are mostly institutions that just grew. Perhaps in some imaginary beginning of time they spontaneously appeared. In their present incarnations, however, they are very much the product of conscious attempts to mold and plan them. We have family law, established and disestablished churches, constitutions and laws, including those governing the economy and the military. Institutions deriving from statute, like joint-stock companies are formal by contrast with informal ones such as friendships. There are some institutions that come in both informal and formal variants, as well as in mixed ones. Consider the fact that the stock exchange and the black market are both market institutions, one formal one not. Consider further that there are many features

of the work of the stock exchange that rely on informal, nonmodifiable agreements, not least the language used for communication. To be precise, mixtures are the norm From constitutions at the top to by-laws near the bottom we are always adding to, or tinkering with, earlier institutions, the grown and the designed are intertwined.

It is usual in social thought to treat culture and tradition as different from, although alongside, institutions. The view taken here is different. Culture and tradition are sub-sets of institutions analytically isolated for explanatory or expository purposes. Some social scientists have taken all institutions, even purely local ones, to be entities that satisfy basic human needs – under local conditions . . . Others differed and declared any structure of reciprocal roles and norms an institution. Most of these differences are differences of emphasis rather than disagreements. Let us straddle all these versions and present institutions very generally . . .as structures that serve to coordinate the actions of individuals. . . . Institutions themselves then have no aims or purpose other than those given to them by actors or used by actors to explain them . . .

Language is the formative institution for social life and for science. Both formal and informal language is involved, naturally grown or designed. (Language is all of these to varying degrees.) Languages are paradigms of institutions or, from another perspective, nested sets of institutions. Syntax, semantics, lexicon and alphabet/character-set are all institutions within the larger institutional framework of a written language. Natural languages are typical examples of what Ferguson called 'the result of human action, but not the execution of any human design'[;] reformed natural languages and artificial languages introduce design into their modifications or refinements of natural language. Above all, languages are paradigms of institutional tools that function to coordinate.

**Q. 5. All of the following inferences from the passage are false, EXCEPT:**

1. As concepts, "culture" and "tradition" have no analytical, explanatory or expository power, especially when they are treated in isolation.
2. "Natural language" refers to that stage of language development where no conscious human intent is evident in the formation of language.
3. Institutions like the family, rituals, governance, economy, and the military are natural and cannot be consciously modified.
4. The institution of friendship cannot be found in the institution of joint-stock companies because the first is an informal institution, while the second is a formal one.

**Q. 6. In the first paragraph of the passage, what are the two "characterisations" that are seen as overlapping but not congruent?**

1. "the philosophy of the social sciences" and "a set of social institutions"
2. "an arena of thought" and "academic disciplines"
3. "academic disciplines" and "institutions"
4. "individuals" and "social structures"

**Q. 7. "Consider the fact that the stock exchange and the black market are both market institutions, one formal one not." Which one of the following statements best explains this quote, in the context of the passage?**

1. Market instruments can be formally traded in the stock exchange and informally traded in the black market.
2. The stock exchange and the black market are both organised to function by rules.
3. The stock exchange and the black market are examples of how, even within the same domain, different kinds of institutions can co-exist.
4. The stock exchange and the black market are both dependent on the market to survive.

**Q. 8. Which of the following statements best represents the essence of the passage?**

1. The stock exchange and the black market are both market institutions.
2. It is usual in social thought to treat culture and tradition as different from institutions.
3. Language is the fundamental formal institution for social life and for science.
4. Institutions are structures that serve to coordinate the actions of individuals.

## Passage 3

**Directions (Q. 9 to 12):** *Read the following passage carefully and answer the questions that follow.*

When we teach engineering problems now, we ask students to come to a single "best "solution defined by technical ideals like low cost, speed to build, and ability to scale. This way of teaching prime students to believe that their decision- making is purely objective, as it is grounded in math and science. This is known as technical-social dualism; the idea that the technical and social dimensions of engineering problems are readily separable and remain distinct throughout the problem-definition and solution process.

Nontechnical parameters such as access to a technology, cultural relevancy or potential harms are deemed political and invalid in this way of learning. But those technical ideals are at their core social and political choices determined by a dominant culture focused on economic growth for the most privileged segments of society. By choosing to downplay public welfare as a critical parameter for engineering design, we risk creating a culture of disengagement from societal concerns amongst engineers that is antithetical to the ethical code of engineering.

In my field of medical devices, ignoring social dimensions has real consequences. . . . Most FDA-approved drugs are incorrectly dosed for people assigned female at birth, leading to unexpected adverse reactions. This is because they have been inadequately represented in clinical trials.

Beyond physical failings, subjective beliefs treated as facts by those in decision-making role scan encode social inequities. For example, spirometers, routinely used devices that measure lung capacity, still have correction factors that automatically assume smaller lung capacity in Black and Asian individuals. These racially-based adjustments are derived from research done by eugenicists who thought these racial differences were biologically determined and who considered nonwhite people as inferior. These machines ignore the influence of social and environmental factors on lung capacity.

Many technologies for systemically marginalised people have not been built because they were not deemed important such as better early diagnostics and treatment for diseases like endometriosis, a disease that afflicts 10 percent of people with uteruses. And we hardly question whether devices are built sustainably, which has led to a crisis of medical waste and health care accounting for 10 percent of U.S. greenhouse gas emissions.

Social justice must be made core to the way engineers are trained. Some universities are working on this. . . . Engineers taught this way will be prepared to think critically about what problems we choose to solve, how we do so responsibly and how we build teams that challenge our ways of thinking.

Individual engineering professors are also working to embed societal needs in their pedagogy. Darshan Karwat at the University of Arizona developed activist engineering to challenge engineers to acknowledge their full moral and social responsibility through practical self-reflection. Khalid Kadir at the University of California, Berkeley, created the popular course Engineering, Environment, and Society that teaches engineers how to engage in place-based knowledge, an understanding of the people, context and history, to design better technical approaches in collaboration with communities. When we design and build with equity and justice in mind, we craft better solutions that respond to the complexities of entrenched systemic problems.

**Q. 9. We can infer that the author would approve of a more evolved engineering pedagogy that includes all of the following EXCEPT:**

1. making considerations of environmental sustainability intrinsic to the development of technologies solutions.
2. moving towards technical-social dualism where social community needs are incorporated in problem-definition and solutions.
3. design that is based on the needs of communities using local knowledge and responding to local priorities.
4. a more responsible approach to technical design and problem-solving than a focus on speed in developing and bringing to scale.

**Q. 10. All of the following are examples of the negative outcomes of focusing on technical ideals in the medical sphere EXCEPT the:**

1. neglect of research and development of medical technologies for the diagnosis and treatment of diseases that typically afflict marginalised communities.
2. exclusion of non-privileged groups in clinical trials which leads to incorrect drug dosages.
3. incorrect assignment of people as female at birth which has resulted in faulty drug interventions.
4. continuing calibration of medical devices based on past racial biases that have remained unadjusted for changes.

**Q. 11. The author gives all of the following reasons for why marginalised people are systematically discriminated against in technology-related interventions EXCEPT:**

1. "And we hardly question whether devices are built sustainably, which has led to a crisis of medical waste and health care accounting for 10 percent of U.S. greenhouse gas emissions."
2. "These racially-based adjustments are derived from research done by eugenicists who thought these racial differences were biologically determined and who considered nonwhite people as inferior."
3. "Beyond physical failings, subjective beliefs treated as facts by those in decision-making roles can encode social inequities."
4. "But those technical ideals are at their core social and political choices determined by a dominant culture focused on economic growth for the most privileged segments of society."

**Q. 12.** In this passage, the author is making the claim that:

1. the objective of best solutions in engineering has shifted the focus of pedagogy from humanism and social obligations to technological perfection.
2. technical-social dualism has emerged as a technique for engineering students to incorporate social considerations into their technical problem-solving processes.
3. engineering students today are taught to focus on objective technical outcomes, independent of the social dimensions of their work.
4. engineering students today are trained to be non-subjective in their reasoning as this best enables them to develop much-needed universal solutions.

## Passage 4

**Directions (Q. 13 to 16):** *Read the following passage carefully and answer the questions that follow.*

[Octopuses are] misfits in their own extended families . . . They belong to the Mollusca class Cephalopoda. But they don't look like their cousins at all. Other molluscs include sea snails, sea slugs, bivalves – most are shelled invertebrates with a dorsal foot. Cephalopods are all arms and can be as tiny as 1 centimetre and as large at 30 feet. Some of them have brains the size of a walnut, which is large for an invertebrate. . . .

It makes sense for these molluscs to have added protection in the form of a higher cognition; they don't have a shell covering them, and pretty much everything feeds on cephalopods, including humans. But how did cephalopods manage to secure their own invisibility cloak? Cephalopods fire from multiple cylinders to achieve this in varying degrees from species to species. There are four main catalysts – chromatophores, iridophores, papillae and leucophores. . . .

Well, what about other colours? Cue the iridophores. Think of a second level of skin that has thin stacks of cells. These can reflect light back at different wavelengths. . . . It's using the same properties that we've seen in hologram stickers, or rainbows on puddles of oil. You move your head and you see a different colour. The sticker isn't doing anything but reflecting light – it's your movement that's changing the appearance of the colour. This property of holograms, oil and other such surfaces is called "iridescence". . . .

Papillae are sections of the skin that can be deformed to make a texture bumpy. Even humans possess them (goosebumps) but cannot use them in the manner that cephalopods can. For instance, the use of these cells is how an octopus can wrap itself over a rock and appear jagged or how a squid or cuttlefish can imitate the look of a coral reef by growing miniature towers on its skin. It actually matches the texture of the substrate it chooses.

Finally, the leucophores. According to a paper, published in Nature, cuttlefish and octopuses possess an additional type of reflector cell called a leucophore. They are cells that scatter full spectrum light so that they appear white in a similar way that a polar bear's fur appears white. Leucophores will also reflect any filtered light shown on them . . . If the water appears blue at a certain depth, the octopuses and cuttlefish can appear blue; if the water appears green, they appear green, and so on and so forth.

**Q. 13. All of the following are reasons for octopuses being "misfits" EXCEPT that they:**

1. exhibit higher intelligence than other molluscs.
2. do not possess an outer protective shell.
3. are consumed by humans and other animals.
4. have several arms.

**Q. 14. Which one of the following statements is not true about the camouflaging ability of Cephalopods?**

1. Cephalopods can change their texture.
2. Cephalopods can change their colour.
3. Cephalopods can take on the colour of their predator.
4. Cephalopods can blend into the colour of their surroundings.

**Q. 15. Based on the passage, we can infer that all of the following statements, if true, would weaken the camouflaging adeptness of Cephalopods EXCEPT:**

1. The number of chromatophores in Cephalopods is half the number of iridophores and leucophores.
2. The temperature of water at the depths at which Cephalopods reside renders the transmission of neural signals difficult.
3. The hydrostatic pressure at the depths at which Cephalopods reside renders radial muscle movements difficult.
4. Light reflects the colours red, green, and yellow at the depths at which Cephalopods reside.

**Q. 16. Based on the passage, it can be inferred that camouflaging techniques in an octopus are most dissimilar to those in:**

1. cuttlefish
2. squids
3. polar bears
4. sea snails

**Q. 17. The four sentences (labelled 1, 2, 3 and 4) given below, when properly sequenced, would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer:**

1. Women may prioritise cooking because they feel they alone are responsible for mediating a toxic and unhealthy food system.
2. Food is commonly framed through the lens of individual choice: you can choose to eat healthily.
3. This is particularly so in a neoliberal context where the state has transferred the responsibility for food onto individual consumers.
4. The individualised framing of choice appeals to a popular desire to experience agency, but draws away from the structural obstacles that stratify individual food choices.

**Q. 18. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.**

Today, many of the debates about behavioural control in the age of big data echo Cold War-era anxieties about brainwashing, insidious manipulation and repression in the 'technological society'. In his book '*Psychopolitics*', Han warns of the sophisticated use of targeted online content, enabling 'influence to take place on a pre-reflexive level'. On our current trajectory, "freedom will prove to have been merely an interlude." The fear is that the digital age has not liberated us but exposed us, by offering up our private lives to machine-learning algorithms that can process masses of personal and behavioural data. In a world of influencers and digital entrepreneurs, it's not easy to imagine the resurgence of a culture engendered through disconnect and disaffiliation, but concerns over the threat of online targeting, polarisation and big data have inspired recent polemics about the need to rediscover solitude and disconnect.

1. The role of technology in influencing public behaviour is reminiscent of

the manner in which behaviour was manipulated during the Cold War.

2. With big data making personal information freely available, the debate on the nature of freedom and the need for privacy has resurfaced.
3. The notion of freedom and privacy is at stake in a world where artificial intelligence is capable of influencing behaviour through data gathered online.
4. Rather than freeing us, digital technology is enslaving us by collecting personal information and influencing our online behaviour.

**Q. 19. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.**

There's a common idea that museum artworks are somehow timeless objects available to admire for generations to come. But many are objects of decay. Even the most venerable Old Master paintings don't escape: pigments discolour, varnishes crack, canvases warp. This challenging fact of art-world life is down to something that sounds more like a thread from a morality tale: inherent vice. Damien Hirst's iconic shark floating in a tank – entitled The Physical Impossibility of Death in the Mind of Someone Living – is a work that put a spotlight on inherent vice. When he made it in 1991, Hirst got himself in a pickle by not using the right kind of pickle to preserve the giant fish. The result was that the shark began to decompose quite quickly – its preserving liquid clouding, the skin wrinkling, and an unpleasant smell wafting from the tank.

1. Museums have to guard timeless art treasures from intrinsic defects such as the deterioration of paint, polish and canvas.
2. Artworks may not last forever; they may deteriorate with time, and the challenge is to slow down their degeneration.
3. The role of museums has evolved to ensure that the artworks are preserved forever in addition to guarding and displaying them.
4. Museums are left with the moral responsibility of restoring and preserving the artworks since artists cannot preserve their works beyond their life.

**Q. 20. The four sentences (labelled 1, 2, 3 and 4) given below, when properly sequenced, would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer:**

1. The trajectory of cheerfulness through the self is linked to the history of the word 'cheer' which comes from an Old French meaning 'face'.
2. Translations of the Bible into vernacular languages, expanded the noun 'cheer' into the more abstract 'cheerful-ness', something that circulates as an emotional and social quality defining the self and a moral community.
3. When you take on a cheerful expression, no matter what the state of your soul, your cheerfulness moves into the self: the interior of the self is changed by the power of cheer.
4. People in the medieval 'Canterbury Tales' have a 'piteous' or a 'sober' cheer; 'cheer' is an expression and a body part, lying at the intersection of emotions and physiognomy.

**Q. 21. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.**

Several of the world's earliest cities were organised along egalitarian lines. In some regions, urban populations governed themselves for centuries without any indication of the temples and palaces that would later emerge; in others, temples and palaces never emerged at all, and there is simply no evidence of a class of administrators or any other sort of ruling stratum. It would seem that the mere fact of urban life does not, necessarily, imply any particular form of political organization, and never did. Far from resigning us to inequality, the picture that is now emerging of humanity's past may open our eyes to egalitarian possibilities we otherwise would have never considered.

1. The emergence of a class of administrators and ruling stratum transformed the egalitarian urban life of ancient cities to the hierarchical civic organisations of today.

2. We now have the evidence in support of the existence of an egalitarian urban life in some ancient cities, where political and civic organisation was far less hierarchical.
3. The lack of hierarchical administration in ancient cities can be deduced by the absence of religious and regal structures such as temples and palaces.
4. Contrary to our assumption that urban settlements have always involved hierarchical political and administrative structures, ancient cities were not organised in this way.

**Q. 22. The four sentences (labelled 1, 2, 3 and 4) given below, when properly sequenced, would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer:**

1. From chemical pollutants in the environment to the damming of rivers to invasive species transported through global trade and travel, every environmental issue is different and there is no single tech solution that can solve this crisis.
2. Discourse on the threat of environmental collapse revolves around cutting down emissions, but biodiversity loss and ecosystem collapse are caused by myriad and diverse reasons.
3. This would require legislation that recognises the rights of future generations and other species that allows the judiciary to uphold a much higher standard of environmental protection than currently possible.
4. Clearly, our environmental crisis requires large political solutions, not minor technological ones, so, instead of focusing on infinite growth, we could consider a path of stable-state economies, while preserving markets and healthy competition.

**Q. 23. There is a sentence that is missing in the paragraph given below. Look at the paragraph and decide in which blank (option 1, 2, 3, or 4) the following sentence would best fit.**

Sentence: This was years in the making but fast-tracked during the pandemic, when "people started being more mindful about their food," he explained.

Paragraph: For millennia, ghee has been a venerated staple of the subcontinental diet, but it fell out of favour a few decades ago when saturated fats were largely considered to be unhealthy. ___(1)___ But more recently, as the thinking around saturated fats is shifting globally, Indians are finding their own way back to this ingredient that is so integral to their cuisine. ____(2)____ For Karmakar, a renewed interest in ghee is emblematic of a return-to-basics movement in India. ____(3) ____ This movement is also part of an overall trend towards "slow food". In keeping with the movement's philosophy, ghee can be produced locally (even at home) and has inextricable cultural ties. ____(4) ____ At a basic level, ghee is a type of clarified butter believed to have originated in India as a way to preserve butter from going rancid in the hot climate.

1. Option 1
2. Option 2
3. Option 3
4. Option 4

**Q. 24. There is a sentence that is missing in the paragraph given below. Look at the paragraph and decide in which blank (option 1, 2, 3, or 4) the following sentence would best fit.**

Sentence: Most were first-time users of a tablet and a digital app.

Paragraph: Aage Badhein's USP lies in the ethnographic research that constituted the foundation of its development process. Customisations based on learning directly from potential users were critical to making this self-paced app suitable for both a literate and non-literate audience. ____(1)____ The user interface caters to a Hindi-speaking audience who have minimal to no experience with digital services and devices. ____(2)____ The content and functionality of the app are suitable for a wide audience. This includes youth preparing for an independent role in life or a student ready to create a strong foundation of financial management early in her life. ____(3)____ Household members desirous of improving their family's financial strength to reach their aspirations can also benefit. We piloted Aage Badhein in early 2021 with over 400 women from rural areas. ____(4)____

The digital solution generated a large amount of interest in the communities.

1. Option 1
2. Option 2
3. Option 3
4. Option 4

# Data Interpretation and Logical Reasoning (DILR)

**Directions (Q. 1 to 5):** *Read the instructions given and answer the questions that follow:*

A few salesmen are employed to sell a product called TRICCEK among households in various housing complexes. On each day, a salesman is assigned to visit one housing complex. Once a salesman enters a housing complex, he can meet any number of households in the time available. However, if a household makes a complaint against the salesman, then he must leave the housing complex immediately and cannot meet any other household on that day. A household may buy any number of TRICCEK items or may not buy any item. The salesman needs to record the total number of TRICCEK items sold as well as the number of households met in each day. The success rate of a salesman for a day is defined as the ratio of the number of items sold to the number of households met on that day. Some details about the performances of three salesmen - Tohri, Hokli and Lahur, on two particular days are given below.

1. Over the two days, all three of them met the same total number of households, and each of them sold a total of 100 items.
2. On both days, Lahur met the same number of households and sold the same number of items.
3. Hokli could not sell any item on the second day because the first household he met on that day complained against him.
4. Tohri met 30 more households on the second day than on the first day.
5. Tohri's success rate was twice that of Lahur's on the first day, and it was 75% of Lahur's on the second day

**Q. 1.** What was the total number of households met by Tohri, Hokli and Lahur on the first day?

**Q. 2.** How many TRICCEK items were sold by Tohri on the first day?

**Q. 3.** How many households did Lahur meet on the second day?

**1.** more than 35 **2.** between 30 and 35
**3.** 20 or less **4.** between 21 and 29

**Q. 4.** How many households did Tohri meet on the first day?

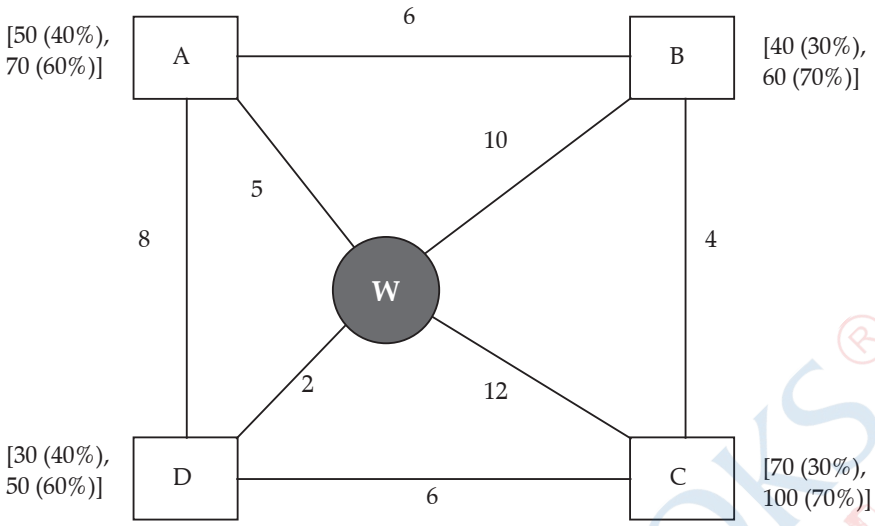
**1.** more than 40
**2.** 10 or less
**3.** between 21 and 40
**4.** between 11 and 20

**Q. 5.** Which of the following statements is FALSE?

**1.** Tohri had a higher success rate on the first day compared to the second day.
**2.** Among the three, Tohri had the highest success rate on the first day.
**3.** Among the three, Tohri had the highest success rate on the second day.
**4.** Among the three, Lahur had the lowest success rate on the first day.

**Directions (Q. 6 to 10):** *Answer the questions on the basis of the information given below.*

Every day, a widget supplier supplies widgets from the warehouse (W) to four locations – Ahmednagar (A), Bikrampore (B), Chitrachak (C), and Deccan Park (D). The daily demand for widgets in each location is uncertain and independent of each other. Demands and corresponding probability values (in parenthesis) are given against each location (A, B, C, and D) in the figure given below. For example, there is a 40% chance that the demand in Ahmednagar will be 50 units and a 60% chance that the demand will be 70 units. The lines in the figure connecting the locations and warehouse represent two-way roads connecting those places with the distances (in km) shown beside the line. The distances in both the directions along a road are equal. For example, the road from Ahmednagar to Bikrampore and the road from Bikrampore to Ahmednagar are both 6 km long.




Every day, the supplier gets the information about the demand values of the four locations and creates the travel route that starts from the warehouse and ends at a location after visiting all the locations exactly once. While making the route plan, the supplier goes to the locations in decreasing order of demand. If there is a tie for the choice of the next location, the supplier will go to the location closest to the current location. Also, while creating the route, the supplier can either follow the direct path (if available) from one location to another or can take the path via the warehouse. If both paths are available (direct and via warehouse), the supplier will choose the path with minimum distance.

**Q. 6.** If the last location visited is Ahmednagar, then what is the total distance covered in the route (in km)?

**Q. 7.** If the total number of widgets delivered in a day is 250 units, then what is the total distance covered in the route (in km)?

**Q. 8.** What is the chance that the total number of widgets delivered in a day is 260 units and the route ends at Bikrampore?

**1.** 7.56% **2.** 33.33%

**3.** 17.64% **4.** 10.80%

**Q. 9.** If the first location visited from the warehouse is Ahmednagar, then what is the chance that the total distance covered in the route is 40 km?

**1.** 5.4% **2.** 18%

**3.** 30% **4.** 3.24%

**Q. 10.** If Ahmednagar is not the first location to be visited in a route and the total route distance is 29 km, then which of the following is a possible number of widgets delivered on that day?

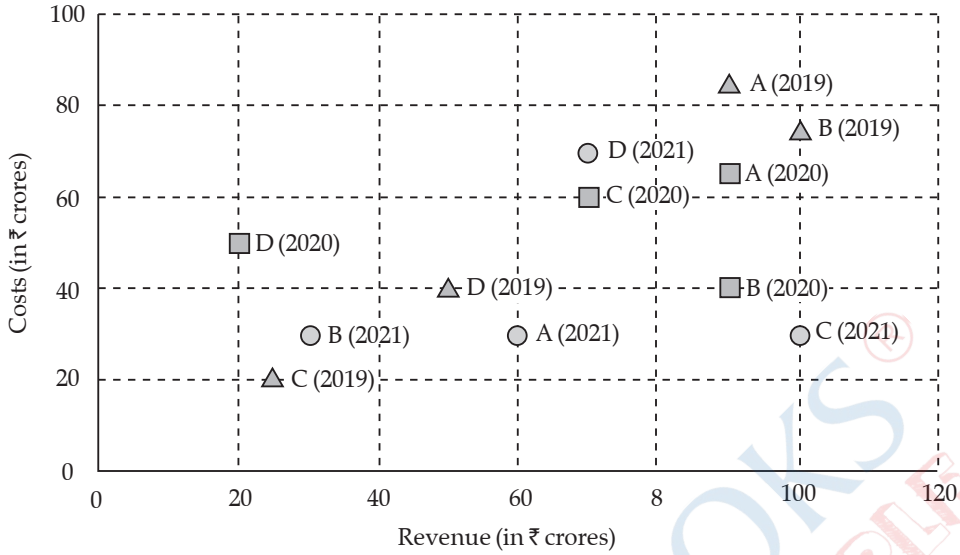
**1.** 220 **2.** 200

**3.** 250 **4.** 210

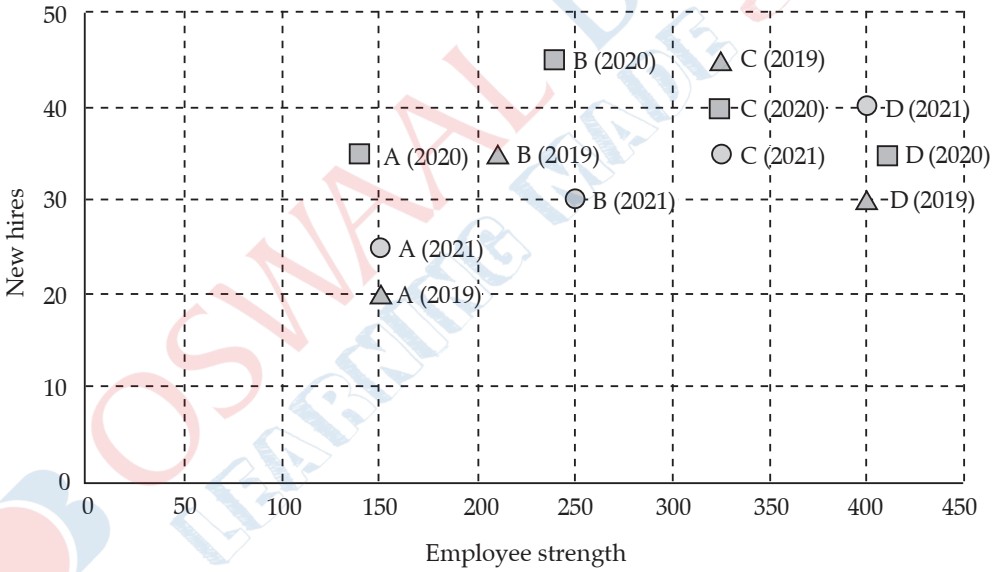
**Directions (Q. 11 to 15):** *Answer the questions based on the following information.*

The two plots given below show data for four company codes-named A, B, C, and D over three years - 2019, 2020, and 2021.

The first plot shows the revenues and costs incurred by the companies during these years. For example, in 2021, company C earned ₹ 100 crores in revenue and spent ₹ 30 crores. The profit of a company is defined as its revenue minus its costs.




The second plot shows the number of employees employed by the company (employee strength) at the start of each of these three years, as well as the number of new employees hired each year (new hires). For example, Company B had 250 employees at the start of 2021, and 30 new employees joined the company during the year.




**Q. 11.** Considering all the three years, which company had the highest annual profit?

**1.** Company A **2.** Company B
**3.** Company C **4.** Company D

**Q. 12.** Which of the four companies experienced the highest annual loss in any of the years?

**1.** Company A **2.** Company D
**3.** Company C **4.** Company B

**Q. 13.** The ratio of a company's annual profit to its annual costs is a measure of its performance. Which of the four companies had the lowest value of this ratio in 2019?

**1.** Company C **2.** Company A
**3.** Company B **4.** Company D

**Q. 14.** The total number of employees lost in 2019 and 2020 was the least for:

**1.** Company D **2.** Company C
**3.** Company A **4.** Company B

**Q. 15.** Profit per employee is the ratio of a company's profit to its employee strength. For this purpose, the employee strength in a year is the average of the employee strength at the beginning of that year and the beginning of the next year. In 2020, which of the four companies had the highest profit per employee?

**1.** Company B **2.** Company A
**3.** Company C **4.** Company D

**Directions (Q. 16 to 20):** *Answer the questions based on the following information.*

A speciality supermarket sold 320 products. Each of these products was either a cosmetic product or a nutrition product. Each of these products was also either a foreign product or a domestic product. Each of these products had at least one of the two approvals – FDA or EU.

The following facts are also known:

1. There were equal numbers of domestic and foreign products.
2. Half of the domestic products were FDA approved cosmetic products.
3. None of the foreign products had both the approvals, while 60 domestic products had both the approvals.
4. There were 140 nutrition products; half of them were foreign products.
5. There were 200 FDA approved products. 70 of them were foreign products and 120 of them were cosmetic products.

**Q. 16.** How many foreign products were FDA approved cosmetic products?

**Q. 17.** How many cosmetic products did not have FDA approval?

**1.** 50
**2.** Cannot be determined
**3.** 60
**4.** 10

**Q. 18.** Which among the following options best represents the number of domestic cosmetic products that had both the approvals?

**1.** At least 10 and at most 80
**2.** At least 10 and at most 60
**3.** At least 20 and at most 70
**4.** At least 20 and at most 50

**Q. 19.** If 70 cosmetic products did not have EU approval, then how many nutrition products had both the approvals?

**1.** 30 **2.** 10
**3.** 50 **4.** 20

**Q. 20.** If 50 nutrition products did not have EU approval, then how many domestic cosmetic products did not have EU approval?

# Quantitative Aptitude (QA)

**Q. 1.** Working alone, the time taken by Anu, Tanu and Manu to complete any job are in the ratio 5 : 8 : 10. They accept a job which they can finish in 4 days if they all work together for 8 hours per day. However, Anu and Tanu work together for the first 6 days, working 6 hours 40 minutes per day. Then, the number of hours that Manu will take to complete the remaining job working alone is:

**Q. 2.** Mr. Pinto invests one-fifth of his capital at 6%, one-third at 10% and the remaining at 1%, each rate being simple interest per annum. Then, the minimum number of years required for the cumulative interest income from these investments to equal or exceed his initial capital is:

**Q. 3.** Regular polygons A and B have number of sides in the ratio 1 : 2 and interior angles in the ratio 3 : 4. Then, the number of sides of B equals:

**Q. 4.** The number of distinct integer values of satisfying $\frac{4-\log 2\, n}{3-\log_4 n}<0$ is:

**Q. 5.** The average of a non-decreasing sequence of N numbers $a_1, a_2, \ldots\ldots, a_N$ is 300. If $a_1$ is replaced by $6a_1$, the new average becomes 400. Then, the number of possible values of $a_1$ is:

**Q. 6.** If $a$ and $b$ are non-negative real numbers such that $a + 2b = 6$, then the average of the maximum and minimum possible values of $(a + b)$ is:

**1.** 3.5 **2.** 4.5
**3.** 3 **4.** 4

**Q. 7.** The length of each side of an equilateral triangle ABC is 3 cm. Let D be a point on BC such that the area of triangle ADC is half the area of triangle ABD. Then, the length of AD, in cm, is:

**1.** $\sqrt{7}$ **2.** $\sqrt{6}$
**3.** $\sqrt{8}$ **4.** $\sqrt{5}$

**Q. 8.** The number of integers greater than 2000 that can be formed with the digits 0, 1, 2, 3, 4, 5, using each digit at most once is:

**1.** 1480 **2.** 1440
**3.** 1200 **4.** 1420

**Q. 9.** Let $f$(x) be a quadratic polynomial in $x$ such that $f(x) \geq 0$ for all real numbers $x$. If $f(2) = 0$ and $f(4) = 6$, then $f(-2)$ is equal to:

**1.** 36 **2.** 12
**3.** 24 **4.** 6

**Q. 10.** Manu earns ₹ 4000 per month and wants to save an average of ₹ 550 per month in a year. In the first nine months, his monthly expense was ₹ 3500, and he foresees that, tenth month onwards, his monthly expense will increase to ₹ 3700. In order to meet his yearly savings target, his monthly earnings, in rupees, from the tenth month onwards should be:

**1.** 4350 **2.** 4400
**3.** 4300 **4.** 4200

**Q. 11.** In an election, there were four candidates and 80% of the registered voters casted their votes. One of the candidates received 30% of the casted votes while the other three candidates received the remaining casted votes in the proportion 1 : 2 : 3. If the winner of the election received 2512 votes more than the candidate with the second highest votes, then the number of registered voters was:

**1.** 62800 **2.** 50240
**3.** 40192 **4.** 60288

**Q. 12.** On day one, there are 100 particles in a laboratory experiment. On day $n$, where $n \geq 2$, one out of every $n$ particles produces another particle. If the total number of particles in the laboratory experiment increases to 1000 on day $m$, then $m$ equals:

**1.** 19 **2.** 17
**3.** 16 **4.** 18

**Q. 13.** There are two containers of the same volume; the first container half-filled with sugar syrup and the second container half-filled with milk. Half the content of the first container is transferred to the second container, and then the half of this mixture is transferred back to the first container. Next, half the content of the first container is transferred back to the second container. Then, the ratio of sugar syrup and milk in the second container is:

**1.** 6 : 5 **2.** 5 : 6
**3.** 4 : 5 **4.** 5 : 4

**Q. 14.** Five students, including Amit, appear for an examination in which possible marks are integers between 0 and 50, both inclusive. The average marks for all the students is 38 and exactly three students got more than 32. If no two students got the same marks and Amit got the least marks among the five students, then the difference between the highest and lowest possible marks of Amit is:

**1.** 22 **2.** 20
**3.** 21 **4.** 24

**Q. 15.** Two ships meet mid-ocean, and then, one ship goes south and the other ship goes west, both travelling at constant speeds. Two hours later, they are 60 km apart. If the speed of one of the ships is 6 km per hour more than the other one, then the speed, in km per hour, of the slower ship is:

**1.** 24 **2.** 18
**3.** 20 **4.** 12

**Q. 16.** For some natural number $n$, assume that (15,000) ! is divisible by ($n$!)!. The largest possible value of $n$ is:

**1.** 5 **2.** 4
**3.** 6 **4.** 7

**Q. 17.** Suppose for all integers $x$, there are two functions $f$ and $g$ such that $f(x) + f(x-1) - 1 = 0$ and $g(x) = x^2$. If $f(x^2 - x) = 5$, then the value of the sum $f(g(5)) + g(f(5))$ is:

**Q. 18.** In triangle ABC, altitudes AD and BE are drawn to the corresponding bases. If $\angle BAC = 45°$ and $\angle ABC = \theta$, then $\frac{AD}{BE}$ equals:

**1.** $\sqrt{2}\cos\theta$ **2.** 1
**3.** $\sqrt{2}\sin\theta$ **4.** $\frac{(\sin\theta + \cos\theta)}{\sqrt{2}}$

**Q. 19.** The number of integer solutions of the equation $(x^2 - 10)^{(x^2 - 3x - 10)} = 1$ is:

**Q. 20.** Let $r$ and $c$ be real numbers. If $r$ and $-r$ are roots of $5x^3 + cx^2 - 10x + 9 = 0$, then $c$ equals:

**1.** 4 **2.** –4
**3.** $-\frac{9}{2}$ **4.** $\frac{9}{2}$

**Q. 21.** Consider the arithmetic progression 3, 7, 11,… and let $A_n$ denote the sum of the first $n$ terms of this progression.

Then, the value of $\frac{1}{25}\sum_{n=1}^{25} A_n$ is:

**1.** 442 **2.** 404
**3.** 455 **4.** 415

**Q. 22.** In an examination, there were 75 questions. 3 marks were awarded for each correct answer, 1 mark was deducted for each wrong answer and 1 mark was awarded for each unattempted question. Rayan scored a total of 97 marks in the examination. If the number of unattempted questions was higher than the number of attempted questions, then the maximum number of correct answers that Rayan could have given in the examination is:

# Answer Key

## Verbal Ability and Reading Comprehension (VARC)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (1) | **2.** (1) | **3.** (3) | **4.** (1) | **5.** (2) | **6.** (4) | **7.** (3) | **8.** (4) | **9.** (2) | **10.** (3) |
| **11.** (1) | **12.** (3) | **13.** (3) | **14.** (4) | **15.** (1) | **16.** (4) | **17.** 2431 | **18.** (2) | **19.** (2) | **20.** 3142 |
| **21.** (2) | **22.** 2143 | **23.** (3) | **24.** (4) | | | | | | |

## Data Interpretation and Logical Reasoning (DILR)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** 84 | **2.** 40 | **3.** (4) | **4.** (2) | **5.** (4) | **6.** 35 | **7.** 38 | **8.** (1) | **9.** (2) | **10.** (4) |
| **11.** (3) | **12.** (2) | **13.** (2) | **14.** (4) | **15.** (1) | **16.** 40 | **17.** (3) | **18.** (2) | **19.** (2) | **20.** 50 |

## Quantitative Aptitude (QA)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** 6 | **2.** 20 | **3.** 10 | **4.** 47 | **5.** 14 | **6.** (2) | **7.** (1) | **8.** (2) | **9.** (3) | **10.** (2) |
| **11.** (1) | **12.** (1) | **13.** (2) | **14.** (2) | **15.** (2) | **16.** (4) | **17.** 12 | **18.** (3) | **19.** 4 | **20.** (3) |
| **21.** (3) | **22.** 24 | | | | | | | | |

# CAT 2022 | SHIFT-2 | SOLVED PAPER

## Answers and Explanations

### Verbal Ability and Reading Comprehension (VARC)

**1. Option (1) is correct.**

The passage discusses the notion that creating music is a basic and universal aspect of the human experience, and that it has a long sociocultural and biological history. According to the author, humans are born with the ability to "musicking," or create music, and it is closely tied to other human abilities like language and symbol creation. The author understands that different cultures express and develop musical abilities differently, yet he or she still believes that all people have some degree of these abilities. This is all aptly summed up in option (1).

**2. Option (1) is correct.**

"If we look back 20,000 years, a small portion of this long period, we reach the lives of humans whose musical abilities were probably little different from our own," the lines say. This suggests that option (1) is the correct answer.

Option (2) is outright eliminated because music is not mentioned as a form of expression.

Options (3) and (4) are too extreme, and they are not supported by the information given in the passage. Hence, both are ruled out.

**3. Option (3) is correct.**

If we carefully read the first three lines of the passage, it is very clear that although the statement "humans today make music" may be followed by a number of disclaimers and concerns, the statement is fundamentally accurate. The author says that everyone is a musician in some capacity or the other. Hence, option (3) is correct answer.

The term "bare statement" merely means that the statement is delivered in an uncomplicated and plain manner. Here the author is advocating for a naked and straightforward presentation of the claim that "humans now generate music," but the author does not imply that the claim itself is without limitations or considerations. Hence, option (1) is incorrect.

The author wants readers to think about the statement that "humans now generate music" without being caught up in different caveats and considerations. It never suggests that readers should allow musical expressions to be unrestricted or uncontrolled. Hence, option (2) is ruled out.

The phrase "trail after" does not suggest that a bold statement is necessarily followed by a series of qualifying clarifications and conditions. But it simply states that something follows after something else. Thus, option (4) is ruled out.

**4. Option (1) is correct.**

The passage asserts that musicking is an inborn capacity of human beings. If the given option is that musical capacities are primarily socio-cultural, this implies that music is primarily shaped by social and cultural evolution rather than being inborn, which contradicts the main idea of the passage. Hence, option (1) is the correct answer.

Since the passage does not talk about human survival, we can outright eliminate option (2).

The author claims that musicking is a universal aspect of human beings. But he doesn't assert anything about music originating from a conscious or unconscious disposition. Indeed, the authors contend that music is an innate human ability.This is not contradicted by the reference to the origin of musicking. Hence, option (3) is also ruled out.

In the penultimate paragraph, the author mentions that musicking is different from language and symbol, but the passage does not suggest that musicking is older than language and symbol. In fact, the author notes that the emergence of musicking can be traced back to at least 50,000 years ago, which is relatively recent in evolutionary terms. Even if this were true, it does not weaken the author's claim. Hence, option (4) is eliminated.

**5. Option (2) is correct.**

The question asks to select the option that is not false (true) as per the passage. Refer to the line: "Natural language" refers to that stage of

language development where no conscious human intent is evident in the formation of language. We can safely conclude from this line that natural languages are not designed by humans but are the natural result of human actions. Hence, option (2) is the correct answer.

The passage states that culture and tradition can be understood as subsets of institutions and have analytical, explanatory, and expository power when they are studied in this context. Option (1) cannot be deduced from this statement. Hence, it is ruled out.

Option (3) contradicts the facts stated in the passage. Rather, it says they are very much the product of conscious attempts to mold and plan them. We have family law, established and disestablished churches, constitutions, and laws, including those governing the economy and the military, and so on. Hence, option (3) is eliminated.

The passage also asserts that both informal and formal institutions exist and that many institutions are a mixture of the two rather than being mutually exclusive categories. Hence, option (4) is also ruled out.

**6. Option (4) is correct.**

Refer to the lines: "We begin with the emergence of the philosophy of the social sciences as an arena of thought and as a set of social institutions. The two characterizations overlap but are not congruent. Academic disciplines are social institutions." The author contends that although these two descriptions share the study of social phenomena, they are incongruent because social institutions are particular structures that direct and coordinate social action, whereas the philosophy of the social sciences is a field of study that encompasses a wide range of ideas and theories. Although they are connected, they are not the same and can be thought of as different but linked social science subfields.

**7. Option (3) is correct.**

The author states that there are some institutions that come in both informal and formal variants, as well as mixed ones. The stock exchange and the black market are both market institutions, but the stock exchange is formal while the black market is not. This implies that the two institutions, though different in the way they are structured and operate, coexist within the same domain. This makes option (3) the correct answer.

The rest of the options are irrelevant to the passage. Hence, they are eliminated.

**8. Option (4) is correct.**

The chapter explores the idea of institutions in relation to social science philosophy. In this context, the author covers many sorts of institutions, including universal institutions, formal institutions, and informal institutions. Institutions are thought of as organisations that coordinate the actions of individuals and can be either formal or informal. The author also makes the case that language is a crucial institution that has a significant impact on social life and science, and that culture and tradition can be understood as subsets of institutions. The author acknowledges that various social scientists may have diverse perspectives on institutions, but that these variations are frequently ones of focus rather than fundamental disputes. The paragraph emphasises that these institutions are organisations that direct people's actions. Option (4) best captures the idea of the passage.

**9. Option (2) is correct.**

According to the paragraph, all of the options are likely to be supported by the author. But option (2), which would involve a shift toward technical-social dualism, is not supported by the passage. According to the passage, technical-social dualism is the belief that engineering issues' technical and social components can be easily distinguished from one another and hold this distinction throughout the problem-definition and solution procedures. This method is criticised in the paragraph, which contends that it ignores the social aspects of engineering issues and places too much emphasis on technical principles like cost and efficiency at the expense of broader societal considerations. Thus, the author is unlikely to support the development of technical-social duality. Hence, (2) is the answer.

The passage stresses the necessity for engineers to be conscious of how their job may affect many social groups, especially the environment. Neglecting these aspects is said to lead to technologies that are not sustainable, contributing to a medical waste and health care crises, and accounting for 10% of greenhouse gas emissions in the United States. From this option (1) can be deduced. We have to select an option which won't be supported by the author. So, this option is eliminated.

The text underlines how crucial it is for engineering instruction and practice to take social justice into account. As examples of initiatives to include social justice into engineering education, it cites courses stressing place-based knowledge and community engagement. Such a strategy would entail using local expertise and goals while building technologies that are responsive to community requirements. Hence, option (3) is ruled out.

The passage talks about the consequences of ignoring social dimensions in engineering. It implies that a more responsible method of technical design and problem-solving would take into account all relevant parties and the potential effects of a technology on various stakeholder groups. Hence, option (4) is also ruled out.

**10. Option (3) is correct.**

"Most FDA-approved drugs are incorrectly dosed for people assigned female at birth, resulting in unexpected adverse reactions," according to the lines. This is because they have been inadequately represented in clinical trials. It is apparent that this implies that the emphasis on technical identification is not the cause of inappropriate drug dosing for those who were given the gender "female" at birth, but rather a result of inadequate representation in clinical trials. Hence, option (3) is not the negative outcome of focusing on technical ideals in the medical sphere. And thus, it is the correct answer.

The passage talks about the lack of technologies for "systemically marginalized people," such as those with endometriosis. The passage also discusses "most FDA-approved drugs" being incorrectly dosed for people assigned female at birth due to inadequate representation in clinical trials. These are the negative outcomes of focusing on technical ideals in the medical sphere. Hence, options (1) and (2) are eliminated.

Option (4) is supported by the example of spirometers that have correction factors that presume smaller lung capacity in Black and Asian individuals based on research by eugenicists. Hence, (4) is also eliminated.

**11. Option (1) is correct.**

The paragraph does not mention systemic discrimination against marginalised people in technology-related interventions as a cause of sustainability or medical waste contributing to greenhouse gas emissions. We have to select an option that is not mentioned by the author as a reason for systematically discriminating against marginalised people in technology-related interventions. Option (1) is not mentioned in the passage. Hence, (1) is the correct answer.

The passage highlights how some devices, like spirometers, have adjustment factors that presuppose lower lung capacity in Black and Asian people based on research conducted by eugenicists who believed in racial hierarchy and thought nonwhite people were inferior. This is an illustration of how irrational views can be incorporated into technology and used as facts, resulting in social injustices. Hence, option (2) can be deduced from the passage.

The passage explains how biased beliefs that are regarded as facts by those in ruling positions can lead to physical failures, like erroneous drug dosage for people who are assigned female at birth, and also encode social inequities, like the correction factors on spirometers that assume smaller lung capacity in Black and Asian people. This makes option (3) correct as per the passage.

According to the passage, dominant cultures frequently decide on technological goals like cost and efficiency by giving the wealthiest sectors of society priority in economic progress. This may lead to technologies and solutions that are not created with marginalised groups' interests and concerns in mind, which may result in systemic discrimination against these groups. Hence, option (4) is correct as per the passage.

**12. Option (3) is correct.**

According to the passage, technical-social dualism is the belief that engineering issues' technical and social components can be easily distinguished from one another and hold this distinction throughout the problem-definition and solution procedures. This method is criticised in the paragraph, which contends that it ignores the social aspects of engineering issues and places too much emphasis on technical principles like cost and efficiency at the expense of broader societal considerations. This supports the claim that engineering students are taught to focus on objective technical outcomes, independent of the social dimensions of their work.

**13. Option (3) is correct.**

From the line: "Some of them have brains the size of a walnut, which is large for an invertebrate." We can derive option (1). And from the line: "Other molluscs include sea snails, sea slugs, bivalves - most are shelled invertebrates with a dorsal foot." We can derive option (2). Similarly, from the line: "but cephalopods are all arms," option (4) can be derived. Three of the options show that Octopus are misfit in their own extended family. But option (3) draws similarity by saying, "pretty much everything feeds on cephalopods, including humans."

**14. Option (4) is correct.**

Refer to the lines: "Papillae are sections of the skin that can be deformed to make a texture bumpy... For instance, the use of these cells is how an octopus can wrap itself over a rock and appear jagged or how a squid or how a squid or cuttlefish can imitate the look of a coral reef by growing miniature towers on its skin. It actually matches the texture of the substrate it chooses." From these lines, option (1) can be deduced. Hence, it is ruled out.

From the discussion of chromatophores, leucophores, and iridophores, options (2) and (4) can be deduced easily. Hence, these two options are also ruled out. But nothing is stated about cephalopods' ability to take on the colour of their predators.

**15. Option (1) is correct.**

If the number of chromatophores in cephalopods is half the number of iridophores and leucophores, it is not going to impact the camouflaging ability of cephalopods because each of the chromatophores, iridophores, and leucophores have specific [somewhat independent] roles to play. So, it is unclear how the quantity of any one of them is going to influence cephalopods' mechanisms of camouflaging. We have to select an option that would not weaken the camouflaging adeptness of cephalopods. Hence, option (1) is the correct answer.

If the temperature of the water at the depths at which cephalopods reside makes the transmission of neural signals difficult, the mechanism of the camouflage would be restricted. Hence, it would weaken the camouflaging adeptness of cephalopods. We have to select an option that would not weaken the camouflaging adeptness of cephalopods. Hence, option (2) is ruled out.

If the hydrostatic pressure at the depths at which cephalopods reside renders radial muscle movements difficult. The mechanism of the camouflage would be restricted. Hence, it would weaken the camouflaging adeptness of cephalopods. We have to select an option that would not weaken the camouflaging adeptness of cephalopods. Hence, option (3) is also ruled out.

"Chromomatophores" are organs on their bodies that contain pigment sacs, which have red, yellow, and brown pigment granules. Why these three colours? Because these are the colours the light reflects at the depths they live in (the rest is absorbed before it reaches those depths)." This argument will become weak if light reflects the colours red, green, and yellow at the depths at which cephalopods reside. because that would limit the camouflaging adeptness. Hence, option (4) is ruled out.

**16. Option (4) is correct.**

Refer to the lines: "The use of these cells is how an octopus can wrap itself over a rock and appear jagged or how a squid or cuttlefish can imitate the look of a coral reef by growing miniature towers on its skin." Also, "They are cells that scatter full spectrum light so that they appear white in a similar way that a polar bear's fur appears white." Based on the last two paragraphs of the passage, we can deduce that there are some similarities between the camouflage of an octopus and a cuttlefish, an octopus and a polar bear, and an octopus and a squid. But there is no reference given to show any similarity in camouflaging between an octopus and a snail.

**17. Correct answer is [2431].**

The topic of the paragraph is "food being framed as individual choice." Sentence 2 introduces the subject of the passage. Hence, it will be the obvious opener. Sentence 4 carries forward the idea by saying that the individualized framing of food appeals to a popular desire. Hence, 2 and 4 are a pair. Sentence 4 will be followed by 3 and 3 will be followed by 1 because 3 is generic and 1 is specific. The sequence number will be 2431.

**18. Option (2) is correct.**

The paragraph states how targeted internet information and large data may be used to possibly sway opinions and alter behaviour, raising issues with privacy and freedom in the digital era. This is demonstrated by the claims

that the use of targeted online information might allow "influence to take place on a pre-reflexive level" and that "behavioural control" in the age of big data reminds us of concerns from the Cold War era about "brainwashing" and "repression." The paragraph addresses the worry that, rather than liberating us, the digital age has exposed us by making behavioural and personal information accessible to machine-learning algorithms. Option (2) aptly summarised the information. Hence, it is the answer.

Option (1) though, is correct as per the passage, yet it is an example to explain the key idea. It is not the key idea that the author wants to convey through the passage. Hence, it is ruled out.

Option (3) is a distortion of fact; the passage talks about machine-based algorithms, not artificial intelligence. Hence, option (3) is also ruled out.

Option (4) is an extreme option. Hence, it is also ruled out.

**19. Option (2) is correct.**

The passage elaborates that contrary to the belief that museum artworks are timeless works of art, there is an "inherent vice," or the natural tendency of certain artworks to deteriorate over time due to various factors. This is aptly summed up in option (2). Hence, it is the correct answer.

Option (1) is ruled out because it gives the impression that museums have an obligation to preserve artwork, which is not the tone of the passage.

Similarly, the passage is not about the role of museums. Hence, option (3) is also eliminated.

Option (4) talks about "moral responsibility," which is not discussed in the passage. Hence, option (4) is ruled out.

**20. Correct answer is [3142].**

The subject of the paragraph, "cheerful-ness," is introduced in sentence (3). Hence, it will be an obvious opener. Sentence (1) further elaborates the topic, and it is followed by statement (4). This is so because 142 follow a chronological order- starting with the history of the word 'cheer' to Old Bible translations to the Medieval period. Hence, the correct sequence will be 3142.

**21. Option (2) is correct.**

According to the paragraph, some ancient towns were structured in an egalitarian manner with no sign of temples or palaces (which could indicate the absence of a ruling elite or administrators), while in other cities, temples and palaces never emerged at all. The passage focuses on the political and civic organization of ancient cities. This is aptly captured in option (2).

**22. Correct answer is [2143].**

The subject of the paragraph is "discourse on the threat of environmental collapse." This is introduced in statement (2). Hence, (2) is the obvious opener. The idea is carried forward in statements (1) and (4) because (1) states that there is no single technological solution that can solve this crisis and (4) emphasises the need for a political solution. The idea of (4) is continued in the statement (3), which gives a solution to the problem. Hence, the sequence is 2143.

**23. Option (3) is correct.**

The sentence “This was years in the making but fast-tracked during the pandemic, when "people started being more mindful about their food", he explained,” is the best fit in the blank (3) The pronoun “he” refers to the statement before blank (3), which mentions the name “Karmakar” for the first time.

**24. Option (4) is correct.**

The sentence "Most were first-time users of a tablet and a digital app," would be best fitted in the blank 4, as it describes the particular group of people that took part in the app's pilot trial. The app was piloted in early 2021 with more than 400 women from rural areas, as was mentioned in the phrase above, and the additional text goes into more depth regarding the precise technological experiences these users had. This information serves to stress the potential influence that the app may have had on these users and clarifies that the pilot study for the app included a sample of people who might be inexperienced with digital devices and services.

## Data Interpretation and Logical Reasoning (DILR)

**Solution for Questions 1 to 5:**

From statement 4,

**For Tohri,**

Number of houses visited by Tohri on first day = $x$

So, Number of houses visited by him on second day = $x + 30$

So, total house visited in two days = $x + x + 30 = 2x + 30$

Let the product sold by Tohri on second day = $n$

Then from statement 1, product sold by him on first day = $100 - n$

**For Lahur,**

From statement 1 and 2, Lahur visited half the total houses on both day.

So, number of houses visited by him on each day = $x + 15$

And from statement 2, number of product sold on each day by Lahur = 50

**For Hokli,**

From statement 1 and 3, Hokli sold all item on first and visited only one house on second day.

Hence, he visited $(2x + 29)$ houses on first day.

| | Day 1 | | | Day 2 | | |
|---|---|---|---|---|---|---|
| | **Products sold** | **Houses visited** | **Success rate** | **Products sold** | **Houses visited** | **Success rate** |
| Tohri | $100 - n$ | $x$ | $\frac{100-n}{x}$ | $n$ | $x + 30$ | $\frac{n}{x+30}$ |
| Hokli | 100 | $2x + 29$ | $\frac{100}{2x+29}$ | 0 | 1 | 0 |
| Lahur | 50 | $x + 15$ | $\frac{50}{x+15}$ | 50 | $x + 15$ | $\frac{50}{x+15}$ |

From statement 5,

$$\frac{100-n}{x} = 2\left[\frac{50}{x+15}\right]$$

$\Rightarrow 100x + 1500 - nx - 15n = 100x$

$\Rightarrow nx + 15n = 1500$

So, $n = \frac{1500}{x+15}$

From statement 5 again,

$$\frac{n}{x+30} = \frac{3}{4}\left[\frac{50}{x+15}\right]$$

$\Rightarrow 4nx + 60n = 150x + 4500$

So, $4x\left[\frac{1500}{x+15}\right] + 60\left[\frac{1500}{x+15}\right] = 150x + 4500$

$\Rightarrow 40x + 600 = (x + 15)(x + 30)$

$\Rightarrow 40x + 600 = x^2 + 45x + 450$

$\Rightarrow x^2 + 5x - 150 = 0$

$\Rightarrow (x + 15)(x - 10) = 0$

$\Rightarrow x = 10$ (–15 is rejected)

As we know, $n = \left[\frac{1500}{x+15}\right]$

So, $n = \left[\frac{1500}{10+15}\right] = 60$

**1. Correct answer is [84].**

Total number of households met by Tohri, Hokli and Lahur on first day = $x + 2x + 29 + x + 15$

$= 10 + 49 + 25 = 84$

**2. Correct answer is [40].**

TRICCEK items were sold by Tohri on the first day = $100 - n$

$= 100 - 60 = 40$.

3. **Option (4) is correct.**
Number of households met by Lahur on second day = $x + 15 = 25$.

4. **Option (2) is correct.**
Number of households met by Tohri on first day = $x = 10$.

5. **Option (4) is correct.**
As already shown in data table, only option three is false because Lahur has the highest success rate on second day.

**Solution for Questions 6 to 10:**

6. **Correct answer is [35].**
It is given that last city is Ahmednagar (A). So, it is only possible when here demand is 50.
Now rest of the cities will be a demand of 50 or more than that.
So as per the given data,
Demand of B = 60
Demand of C = 70 or 100
Demand of D = 50
∴ Sequence of cities according to demand will be C → B → D → A
Distance travelled from,
Warehouse → C = 12
C → B = 4
B → W → D = 12
D → W → A = 7 [Shortest route from D to A is through warehouse and not the direct route]
∴ Total distance travelled = 12 + 4 + 12 + 7
= 35

7. **Correct answer is [38].**
As per given data,
Demand of city A = 50 or 70
Demand of city B = 40 or 60
Demand of city C = 70 or 100
Demand of city A = 30 or 50
It is given that the demand is 250.
It is only possible when demands of cities A, B, C and D are 70, 60, 70 and 50 respectively.
Sequence of cities visited is: A → C → B → D
[A is closer to warehouse than C, hence first city to be visited will be A.]
∴ Total distance travelled = 5 + 17 + 4 + 12
= 38

8. **Option (1) is correct.**
As per given data,
Demand of city A = 50 or 70
Demand of city B = 40 or 60
Demand of city C = 70 or 100
Demand of city D = 30 or 50
For route to end at B, B should have least demand that is 40.
Total demand is 260, hence demand at other cities should be higher of the two values.
∴ Demand at A = 70 (60%)
Demand at B = 40 (30%)
Demand at C = 100 (70%)
Demand at D = 50 (60%)
∴ Required possibility = 60% × 30% × 70% × 60% = 0.6 × 0.3 × 0.7 × 0.6 = 0.0756 = 7.56%

9. **Option (2) is correct.**
As per given data,
Demand of city A = 50 or 70
Demand of city B = 40 or 60
Demand of city C = 70 or 100
Demand of city A = 30 or 50
If first city visited is Ahmednagar, this is possible when A's demand is highest. This is only possible when A's demand is 70.
∴ Demand at C should be 70
Demand at B = 40 or 60
Demand at D = 30 or 50
∴ Sequence of cities can be A → C → B → D.
Then, distance travelled = 38 km
Or A → C → D → B.
Then distance travelled = 40 km
∴ Demand at D ≥ B ⇒ Demand at D = 50 (60%) and demand at B = 40 (30%)
⇒ Required possibility = 60% × 30% = 18%

10. **Option (4) is correct.**
As per given data,
Demand of city A = 50 or 70
Demand of city B = 40 or 60
Demand of city C = 70 or 100
Demand of city D = 30 or 50
If A is not the first city to be visited, the first city will have to be C.
Distance travelled from warehouse to C = 12 km.
∴ To visit the remaining three cities, distance travelled should be 29 – 12 = 17 km.
There are two possibilities for this.
**Case 1:** W → C → B → A → D.
Here, highest demand is from C = 70 or 100
Second highest demand is from B = 60

Third highest demand is from A = 50
Fourth highest demand is from D = 30
Total widgets delivered can be 210 or 240
**Case 2:** W → C → D → A → B
Here, highest demand is from C = 70 or 100
Second highest demand is from D = 50
Third highest demand is from A = 50
Fourth highest demand is from B = 40
Total widgets delivered can be 210 or 240.
[*Note:* shortest route from A to D or vice-versa is through the warehouse.]

**Solution for Questions 11 to 15:**

Tabulated form of given data, Income, Expenses and profit:

| | A | | | B | | | C | | | D | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Income** | **Expense** | **Profit** | **Income** | **Expense** | **Profit** | **Income** | **Expense** | **Profit** | **Income** | **Expense** | **Profit** |
| 2019 | 90 | 85 | 5 | 100 | 75 | 25 | 25 | 20 | 5 | 50 | 40 | 10 |
| 2020 | 90 | 65 | 25 | 90 | 40 | 50 | 70 | 60 | 10 | 20 | 50 | – 30 |
| 2021 | 60 | 30 | 30 | 30 | 30 | 0 | 100 | 30 | 70 | 70 | 70 | 0 |

Employees:

| | A | | | B | | | C | | | D | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Start** | **Join** | **End** | **Start** | **Join** | **End** | **Start** | **Join** | **End** | **Start** | **Join** | **End** |
| 2019 | 150 | 20 | 170 | 210 | 35 | 245 | 325 | 45 | 370 | 400 | 30 | 430 |
| 2020 | 140 | 35 | 175 | 240 | 45 | 285 | 325 | 40 | 365 | 410 | 35 | 445 |
| 2021 | 150 | 25 | 175 | 250 | 30 | 280 | 325 | 35 | 360 | 400 | 40 | 440 |

**11. Option (3) is correct.**
Cumulative profit of 3 years for,
Company A = 5 + 25 + 30 = ₹ 60 crores profit
Company B = 25 + 50 + 0 = ₹ 75 crores profit
Company C = 5 + 10 + 70 = ₹ 85 crores profit
Company D = 10 – 30 + 0 = ₹ 20 crores loss
Highest cumulative profit is for company C.

**12. Option (2) is correct.**
From the tabulated data, Company D suffered highest loss for any particular year in 2020.

**13. Option (2) is correct.**
Ratio of (Annual profit) / (Annual Cost) in 2019 for
A = 5/85 = 1/17
B = 25/75 = 1/3
C = 5/20 = 1/4
D = 10/40 = 1/4
This ratio is lowest for Company A.

**14. Option (4) is correct.**
Employees lost in 2019 and 2020 for
A = (170 – 140) = 30
B = (245 – 240) = 5
C = (370 – 325) = 45
D = (430 – 410) = 20
Least number of employees left is for B.

**15. Option (1) is correct.**

Profit per employee for,

$$\text{Company A} = \frac{25}{\frac{175+175}{2}} = \frac{25}{175} = \frac{1}{7}$$

$$\text{Company B} = \frac{50}{\frac{285+280}{2}} = \frac{100}{565} = \frac{20}{113}$$

$$\text{Company C} = \frac{10}{\frac{365+360}{2}} = \frac{20}{725} = \frac{4}{145}$$

$$\text{Company D} = \frac{-30}{\frac{445+440}{2}} = -\frac{60}{885} = -\frac{12}{177}$$

So, the ratio is highest for company B.

**Solution for Questions 16 to 20:**
Given that, there were equal number of domestic and foreign products.
So, there will be 160 foreign as well as domestic product.
Half of the domestic products were FDA approved cosmetic products.
∴ 80 products are domestic, FDA approved and cosmetic products.
From statement 4, it is given that there were 140 nutrition product, half of them were foreign product. This means remaining half are domestic.
∴ Number of cosmetic products = 320 – 140 = 180
There were 200 FDA approved products, 70 of them were foreign products
FDA approved products = FDA foreign + FDA domestic
⇒ 200 = 70 + (60 + only FDA domestic products)
⇒ only FDA domestic products = 70
Here, 120 of them were cosmetic products.
FDA approved cosmetic products = FDA approved foreign cosmetic + FDA approved domestic cosmetic
⇒ 120 = (0 + only FDA approved cosmetic foreign products) + 80
⇒ only FDA approved cosmetic foreign products = 40
Since, there are total 70 foreign FDA approved products out of which 40 are only FDA approved cosmetic foreign products,
Hence approved nutrition foreign products = 70 – 40 = 30.
⇒ only EU approved nutrition foreign products = 70 – 30 = 40
Total foreign products = 160
⇒ only EU approved cosmetic foreign products = 160 – 40 – 30 – 40 = 50
Total Cosmetic products is 180 = cosmetic foreign + cosmetic domestic
⇒ 180 = (50 + 0 + 40) + (only EU approved domestic cosmetic products + 80)
⇒ only EU approved domestic cosmetic products = 10
Total domestic products = 160 = (10 + only EU nutrition domestic products) + 60 + 70
⇒ only EU nutrition domestic products = 20

<table>
<tr><td rowspan="8">Total (32)</td><td rowspan="5">Domestic (160)</td><td rowspan="3">Cosmetic (90)</td><td>only EU - 10</td><td>Total EU -</td></tr>
<tr><td>only FDA -</td><td>Total FDA - 80</td></tr>
<tr><td>Both -</td><td></td></tr>
<tr><td rowspan="3">Nutrition (70)</td><td>only EU - 20</td><td>Total Eu -</td></tr>
<tr><td>only FDA -</td><td>Total FDA - 50</td></tr>
<tr><td>Both -</td><td></td></tr>
<tr><td rowspan="3">Foreign (160)</td><td rowspan="2">Cosmetic (90)</td><td colspan="2">EU - 50</td></tr>
<tr><td colspan="2">FDA - 40</td></tr>
<tr><td rowspan="2">Nutrition (70)</td><td colspan="2">EU - 40</td></tr>
<tr><td colspan="2">FDA - 30</td></tr>
</table>

**16. Correct answer is [40].**
∴ Number of foreign FDA approved cosmetic products = 0 + 40 = 40

**17. Option (3) is correct.**
Number of cosmetic products that did not have FDA approval = 50 + 10 = 60

**18. Option (2) is correct.**
Domestic products which have both approvals = 60.
∴ Domestic cosmetic products with both approvals cannot be more than 60.
Maximum only FDA approved cosmetic domestic products can be 70, hence minimum cosmetic domestic products with both approvals can be 10.

**19. Option (2) is correct.**
If 70 cosmetic products did not have EU approval, then number of nutrition products with both approvals = only FDA approved cosmetic (foreign + domestic) products
⇒ 70 = 40 + only FDA approved cosmetic domestic products ⇒ only FDA approved cosmetic domestic products = 30
Number of nutrition products with both approvals = 0 + 10 = 10

**20. Correct answer is [50].**
50 nutrition products did not have EU approval = 30 + only FDA domestic nutrition products
⇒ only FDA domestic nutrition products = 20
∴ Number of domestic cosmetic products without EU approval = 50

## Quantitative Aptitude (QA)

**1. Correct answer is [6].**

Let time taken by Anu, Tanu and Manu alone be $5x$ hours, $8x$ hours and $10x$ hours respectively.

A.T.Q

$$\frac{1}{5x}+\frac{1}{8x}+\frac{1}{10x}=\frac{1}{32}\Rightarrow x=\frac{68}{5}$$

Since, Anu and Tanu work together for first 6 days, working 6 hours 40 minutes

$$\text{Time}=36+\frac{40}{60}\times 6=40 \text{ hours}$$

Let Manu take $y$ hours to complete the remaining job.

$40(8+5)+y(4)=40x\Rightarrow y=6.$

**2. Correct answer is [20].**

Let total investment of Mr. Pinto be $15x$ and number years be $n$ years.

$$\therefore \frac{3x\times 6\times n}{100}+\frac{5x\times 10\times n}{100}+\frac{7x\times 1\times n}{100}\geq 15x$$

$$\Rightarrow \frac{75xn}{100}\geq 15x\Rightarrow n\geq 20$$

So, minimum number of years = 20 years.

**3. Correct answer is [10].**

Let number of sides of polygons A and B be $n$ and $2n$.

We have interior angle $=\frac{(n-2)\times 100}{n}$

$$\therefore \frac{\frac{(n-2)\times 100}{n}}{\frac{(2n-2)\times 100}{2n}}=\frac{3}{4}$$

$$\Rightarrow \frac{2(n-2)}{2n-2}=\frac{3}{4}$$

$\Rightarrow 8n-16=6n-6\Rightarrow n=5$

$\therefore$ Number of sides of B $=2\times 5=10$

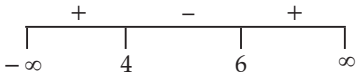
**4. Correct answer is [47].**

Given that $\frac{4-\log_2{}^n}{3-\log_4{}^n}<0$

$$=\frac{4-\log_2{}^n}{3-\frac{1}{2}\log_2{}^n}<0$$

Let $\log_2{}^n=x$

$$\therefore \frac{4-x}{6-x}<0\Rightarrow \frac{x-4}{x-6}<0$$




$\therefore 4<x<6\Rightarrow 4<\log_2{}^n<6$

$\Rightarrow 2^4<n<2^6\Rightarrow 16<n<64$

$\therefore$ Number integer value of $n$ is 47.

**5. Correct answer is [14].**

Given that,

Average of $N$ number = 300

$$\therefore \quad a_1+a_2+\ldots+a_N=300N \qquad \ldots(i)$$

When replace $a_1$ by $6a_1$ then average be 400

$$\therefore \quad 6a_1+a_2+\ldots+a_N=400N \qquad \ldots(ii)$$

Subtract (i) from (ii) we get

$$5a_1=100N\Rightarrow a_1=20N$$

$\therefore$ We can take the values of $N$ from 2 to 15.

Total values of $a_1$ or $N$ is 14.

**6. Option (2) is correct.**

Given that,

$$a+2b=6$$

$$\Rightarrow \quad a+b=6-b$$

$a+b$ is maximum when $b$ is minimum.

*i.e.* $\quad b=0$

$\therefore$ Maximum value of $a+b=6$

$a+b$ is minimum when $b$ is maximum.

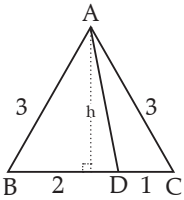
*i.e.* $\quad b=3\ (\because a=6-2b\geq 0)$

$\therefore$ Minimum value of $a+b=3$

$$\text{Average}=\frac{3+6}{2}=4.5$$

**7. Option (1) is correct.**

Given that,




$$\text{Area of } \Delta ADC=\frac{1}{2}\text{ Area of } \Delta ABD$$

$$\frac{1}{2}\times BD\times h=\frac{1}{2}\times\frac{1}{2}\times CD\times h$$

$$\Rightarrow \quad CD=2BD$$

$BC=CD+BD=3BD=3\Rightarrow BD=1$

In $\Delta ABD$, $\angle B=60°$

$$\therefore \cos 60°=\frac{3^2+1^2-AD^2}{2\times 3\times 1}$$

$\Rightarrow \frac{1}{2} \times 6 = 10 - AD^2$

$\Rightarrow AD^2 = 7 \Rightarrow AD = \sqrt{7}$

**8. Option (2) is correct.**

**Case 1:** For 4-digit numbers.

Since, the numbers greater than 2000.

$\therefore$ First digit can be 2, 3, 4 and 5

$\therefore$ Number of 4-digit numbers

$= 4 \times 5 \times 4 \times 3 = 240$

**Case 2:** For 5-digit numbers.

Since, first digit cannot be zero.

$\therefore$ Number of 5-digit numbers.

$= 5 \times 5 \times 4 \times 3 \times 2 = 600$

**Case 3:** For 6-digit numbers.

Since, first digit cannot be zero.

$\therefore$ Number of 6-digit numbers

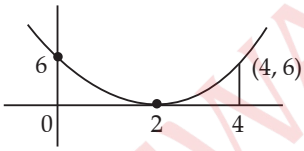
$= 5 \times 5 \times 4 \times 3 \times 2 \times 1 = 600$

Total numbers = 240 + 600 + 600 = 1440

**9. Option (3) is correct.**

Given that,

$f(x) \geq 0$ and $f(2) = 0$, so, $x = 2$ is one root of $f(x) = 0$




Let $f(x) = ax^2 + bx + c$

From figure it is clear that

$f(0) = f(4) = 6 \Rightarrow c = 6$

$\alpha \cdot B = 2 \times 2 = \frac{c}{a} \Rightarrow 4 = \frac{6}{a}$

$\Rightarrow a = 1.5$

$\alpha + B = \frac{-b}{a} \Rightarrow 2 + 2 = \frac{-b}{1.5} \Rightarrow b = -6$

Now, $f(-2) = 4a - 2b + c$

$= 4(1.5) - 2(-6) + 6$

$= 6 + 12 + 6 = 24$

**10. Option (2) is correct.**

Savings target in a year = 550 × 12 = ₹6600

Savings in first nine months

= ₹ (4000 – 3500) × 9 = ₹4500

Remaining savings in next three months

= ₹ (6600 – 4500) = ₹2100

$\therefore$ Savings each month in next three months

$= \frac{1}{2} \times 2100 =$ ₹700

Monthly income each month for next three months = 3700 + 700 = ₹4400

**11. Option (1) is correct.**

Let total registered voters = $x$

Total casted votes = $\frac{8x}{10}$

One candidates received = $\frac{8x}{10} \times \frac{30}{100} = \frac{24x}{100}$

Remaining votes = $\frac{8x}{10} - \frac{24x}{100} = \frac{56x}{100}$

Votes received by other three candidates $\frac{56x}{600}$, $\frac{2 \times 56x}{600}$ and $\frac{3 \times 56x}{600}$ respectively.

A.T.Q.

$$\frac{3 \times 56x}{600} - \frac{24x}{100} = 2512$$

$\Rightarrow \frac{24x}{100} = 2512 \Rightarrow x = \frac{2512 \times 100}{24}$

$\Rightarrow x = 62800$

**12. Option (1) is correct.**

| $n=1$ | $n=2$ | $n=3$ | $n=4$ | ... | $n=m$ |
|---|---|---|---|---|---|
| ↓ | ↓ | ↓ | ↓ | | ↓ |
| 100 | $1+\frac{1}{2}$ | $1+\frac{1}{3}$ | $1+\frac{1}{4}$ | | $1+\frac{1}{m}$ |
| | ↓ | ↓ | ↓ | | ↓ |
| | $\frac{3}{2}$ | $\frac{4}{3}$ | $\frac{5}{4}$ | | $\frac{m+1}{m}$ |

$\therefore 100 \times \frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} \cdots \times \frac{m+1}{m} = 100$

$\Rightarrow 100 \times \frac{1}{2} \times (m+1) = 100 \Rightarrow m = 19$

**13. Option (2) is correct.**

Let first container 100 L sugar syrup and second container 100 L milk.

**Step 1.** Half transfer from first to second.

First container

Sugar = 50 L

Second container

Sugar = 50 L

Milk = 100 L

**Step 2.** Half transfer from second to first.

Second container

Sugar = 25 L

Milk = 50 L

First container

Sugar = 50 + 25 = 75 L

Milk = 50 L

**Step 3.** Half transfer from first to second

First container

Sugar = 37.5 L

Milk = 25 L

Second container

Sugar = 25 + 37.5 = 62.5 L

Milk = 50 + 25 = 75 L

Ratio of Sugar syrup to Milk

$$= \frac{62.5}{75} = \frac{5}{6}$$

**14. Option (2) is correct.**

Total marks of five students = 5 × 38 = 190

For minimum marks of Amit

Since, exactly three students got more than 32.

∴ Maximum possible marks of four students = 50 + 49 + 48 + 32 = 179

∴ Minimum possible marks of Amit = 190 – 179 = 11

For maximum marks of Amit

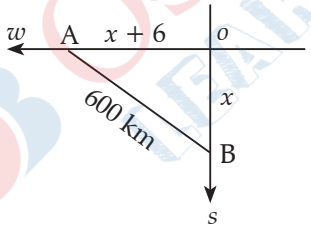
Since, Amit got the least marks among the five students and fourth students got maximum marks 32.

So, Amit got maximum marks = 31

Difference = 31 – 11 = 20

**15. Option (2) is correct.**

Let speed of slower ship is $x$ km/h




∴ Speed of other ship is $(x + 6)$ km/h.

∴ Distance travelled by slower = $2x$ = OB

Distance travelled by other = $2(x + 6)$ = OA

$$\therefore \quad OA^2 + OB^2 = (600)^2$$

$$4x^2 + 4(x + 6)^2 = 3600$$

$$\Rightarrow \quad x^2 + 6x - 432 = 0$$

$$\Rightarrow \quad (x - 18)(x + 24) = 0$$

$x = 18$ or $x = -24$ (Not possible)

∴ Speed of slower ship = 18 km/h.

**16. Option (4) is correct.**

Given that,

(15000)! is divisible by $(n!)!$

$$\therefore \quad \frac{(15000)!}{(n!)!} = \frac{15000}{n!}$$

15000 is divisible by $n!$ is possible when $n! < 15000$

$$7! = < 15000$$

$$8! = > 15000$$

∴ Maximum value of $n$ is 7.

**17. Correct answer is [12].**

Given that,

$f(x) + f(x - 1) = 1$ ...(i)

$f(x^2 - x) = 5$ ...(ii)

$g(x) = x^2$ ...(iii)

Put $x = 1$ in equation (ii)

$f(0) = 5$

Put $x = 1$ in equation (i)

$f(1) + f(0) = 1 \Rightarrow f(1) = 1 - 5 = -4$

Put $x = 2$ in equation (i)

$f(2) + f(1) = 1 \Rightarrow f(2) = 5$

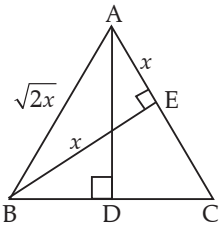
It is clear from above that

$f(x) = 5$ when $x$ is even and $f(x) = -4$ when $x$ is odd.

$\therefore f(g(5)) + g(f(5)) = f(25) + g(-4)$

$= -4 + 16 = 12$

**18. Option (3) is correct.**




In Δ ABE

∠AEB = 90° and ∠BAC = 45°

∴ ∠ABE = 45°

So, AE = BE = $x$ (say)

$$\therefore \quad AB^2 = AE^2 + BE^2$$

$$AB^2 = 2x^2 \Rightarrow AB = \sqrt{2}\,x$$

In Δ ABD

$$\sin\theta = \frac{AD}{AB} = \frac{AD}{\sqrt{2}\,x}$$

$$\Rightarrow \quad \sqrt{2}\sin\theta = \frac{AD}{x} = \frac{AD}{BE}$$

**19. Correct answer is [4].**

Given that,

$(x^2 - 10)(x^2 - 3x - 10) = 1$

**Case 1:** When $x^2 - 3x - 10 = 0$ and $x^2 - 10 \neq 0$

$$x^2 - 3x - 10 = 0$$

$\Rightarrow \quad (x - 5)(x + 2) = 0$

$\Rightarrow \quad x = 5, -2$

**Case 2:** When $x^2 - 10 = 1$

$\Rightarrow \quad x^2 = 11 = x = \sqrt{11}$

(Not integer)

**Case 3:** When $x^2 - 10 = -1$ and $x^2 - 3x - 10$ is even number

$\therefore \quad x^2 = 9$

$\Rightarrow \quad x = -3, 3$

$\therefore \quad (-3)^2 - 3(-3) - 10 = 8$ (even)

$(3)^2 - 3(3) - 10 = -10$ (even)

So, number of integer solutions is 4.

**20. Option (3) is correct.**

Let third roots of $5x^3 + (x^2 - 10x + 9 = 0)$ is $\alpha$.

$$\therefore \quad \alpha + r - r = \frac{-c}{5} \Rightarrow \alpha = \frac{-c}{5} \quad ...(i)$$

$$\alpha r - r^2 - \alpha r = \frac{-10}{5} \Rightarrow r^2 = 2$$

$$\alpha r(-r) = \frac{-9}{5} \Rightarrow \alpha r^2 = \frac{9}{5}$$

$$\frac{-c}{5}(2) = \frac{9}{5} \Rightarrow c = \frac{-9}{2}$$

**21. Option (3) is correct.**

Given A.P. : 3, 7, 11.....

$$\therefore \quad A_n = \frac{n}{2}[6 + (n-2)4] = 2n^2 + n$$

$$\frac{1}{25}\sum_{n=1}^{25} A_n = \frac{1}{25}\sum_{n=1}^{25}(2n^2 + n)$$

$$= \frac{1}{25}\left[2\sum_{n=1}^{25} n^2 + \sum_{n=1}^{25} n\right]$$

$$= \frac{1}{25}\left[\frac{2(25\times 26\times 51)}{6} + \frac{25\times 26}{2}\right]$$

$$= \frac{25}{25}[26\times 17 + 13] = 13[34 + 1]$$

$$= 13 \times 35 = 455$$

**22. Correct answer is [24].**

Let number of correct, incorrect and unattempted questions be $x$, $y$ and $z$ respectively.

A.T.Q

$$x + y + z = 75 \quad ...(i)$$

$$3x - y + z = 97 \quad ...(ii)$$

Subtract eq. (i) from eq. (ii), we get $x - y = 11$

Adding eq. (i) and (ii)

we get $2x + z = 86$ given that

$z > x + y$

$\Rightarrow \quad z > 75 - z$

$\Rightarrow \quad z > 37.5$

Minimum possible value of $z$ is 38.

$2x + 38 = 85$

$\Rightarrow \quad x = 24$

$\therefore$ Maximum number of correct answer is 24.